Gregg Squires #3

## LOW COST COMPUTER MEETING OUTLINE

- I. OBJECTIVES
- II. MAJOR FEATURES
- III. ACCOMPLISHMENTS
- IV. COST
- V. AVAILABILITY
  DETAILED SCHEDULE
- VI. UNRESOLVED ISSUES
- VII. MAJOR SUPPORT
  SOFTWARE
  MECHANICAL ENGINEERING
  LSI
- VIII. DISCUSSION
  - IX. ACTION ITEMS

## LOW COST COMPUTER MAJOR OBJECTIVES

SIGNIFICANTLY ACCELERATE THE PRODUCT DEVELOPMENT SCHEDULE CURRENT SCHEDULE: BEGIN PRODUCTION MAY 1983\* LOW RISK SCHEDULE: BEGIN PRODUCTION 4/15/8

PRODUCE AS MANY UNITS IN 1983 AS POSSIBLE

CURRENT PLAN: 400,000\*\*

MONTEREY:

200,000

INITIAL PLAN: 85,000

AGGRESSIVE COST REDUCTION

CURRENT A400 COST \$127.65 PARTS AND DIRECT LABOR

1983 CRAZY 8 OBJECTIVE: \$ 80.00 OFF-SHORE PARTS AND

DIRECT LABOR

CURRENT CRAZY 8 EST.:

\$ 73.46 OFF-SHORE PARTS AND

DIRECT LABOR

1984 COST OBJECTIVE:

\$ 65,00

ORIGINAL LAB COMMITMENT: PROBABLE, 3RD QUARTER, 1983

DEFINITE, 4TH QUARTER, 1983

BUILT AND IN PIPELINE

## MAJOR OBJECTIVES (CONTINUED)

- OFF-SHORE MANUFACTURE
- SIGNIFICANTLY REDUCE I.C. COUNT

A400: 30 I.C.s

INITIAL CRAZY 8: 12 I.C.s

CRAZY 8: 10 I.C.s

PUT AS MANY DESIRABLE CONSUMER FEATURES AS POSSIBLE

# LOW COST COMPUTER MAJOR FEATURES

- TYPEWRITER STYLE KEYBOARD 3/4 STROKE
- SMALL SIZE, LIGHTWEIGHT
- SOFTWARE, HARDWARE, AND STYLING COMPATIBLE TO 1200XL
- 16K MINIMUM 64K MAXIMUM (INTERNAL)
- 24K ROM INCLUDING ATARI BASIC
- HELP KEY AND SELF TEST
- INTERNATIONAL CHARACTER SET
- 2 JOYSTICK CONNECTORS
- OPTIONAL DUST COVER
- MANUFACTURABILITY
   HOUSING 2 PIECE CONSTRUCTION
   PCB ONE DOUBLE-SIDED
- EXPANSION BUS
   DIRECT VIDEO
   PERITEL POSSIBLE
   5200 EXTERNAL ADAPTOR POSSIBLE
   SPECSMANSHIP

## LOW COST COMPUTER ACCOMPLISHMENTS

- 1. CRITICAL PATH ITEMS ON SCHEDULE
- 2. SCHEMATIC COMPLETE
- 3. 1ST WORKING UNIT DELIVERED
- 4. I.D. COMPLETE
- 5. MECHANICAL DESIGN FROZEN
- 6. PRELIMINARY LIST OF MATERIALS COMPLETE
- 7. COST ESTIMATE COMPLETE (COST OBJECTIVES ARE HOLDING, OR ARE LESS)
- 8. FRED CHIP DESIGN SIGNED OFF FRED MASK MAKING BEGUN
- 9. FRED DOCUMENTATION COMPLETE AND DISTRIBUTED

### ACCOMPLISHMENTS

- 10. KEYBOARD SPEC FROZEN VENDORS BEING QUALIFIED
- 11. ALL MECHANICAL DESIGN FROZEN
- 12. 1ST PASS AT PORKEY CHIP COMPLETE
- 13. PROVISIONS FOR PAM COMPATIBILITY WITH EXTERNAL ADAPTOR
- 14. 2ND PCB IN PROGRESS (64K)
- 15. HAVE EPROMS IN HAND FOR 8K AND 16K
- 16. GOOD CONTACT WITH MANUFACTURING AND ATARI TAIWAN
- 17. INTERNATIONAL PAL AND PERITEL VERIFIED

CRAZY 8: PARTS COST SUMMARY\*
VERSION DATE: JANUARY 7, 1983

ITEM	QUANTITY	COST
RESISTORS CAPACITORS CONNECTORS PC BOARD CUSTOM ICs	71 43 38 1	.368 2.829 4.202 6.6
***FRED	1	3.85
***PORKY	1	2.5
***SALLY	1	3.25
***ANTIC	1	3.57
***GTIA	1	2.54
***BASIC ROM	1	2.5
***RUFUS	1	5.8
OTHER ICs	8 '	12.471
MISC. ELECT.	122	2.8602
KEYBOARD	1	8
OTHER MECH	9	3.576
PWR ADAPTOR	1	3.41
OTHER PKOUT	10	3.63
TOTALS (16K)	311	71.9562

PLUS: DUTIES, SHIPPING, OVERHEAD, AND LABOR (.55 HOURS FINAL ASSEMBLY AND TEST)

<sup>\*</sup> REVISED VERSION ON 1/14/83

### LOW COST COMPUTER

### KEY MILESTONES

JANUARY 15	RELEASE OF PRELIMINARY DOCUMENTATION
JANUARY 24	2ND PASS OF PORKEY IC
FEBRUARY 1	MATERIAL ACQUISITION COMPLETELY REVIEWED LONG LEAD TIME ITEMS ORDERED
FEBRUARY 7	SAN JOSE SOFT TOOL COMPLETE
FEBRUARY 8	1ST FRED SILICON
FEBRUARY 14	WORKING UNIT WITH PCB, CUSTOM ICs (I.E., FRED PORKEY) AND OPERATING SYSTEM
FEBRUARY 14	START TOOLING EFFORT IN FAR EAST
FEBRUARY 28	SUBMIT TO LAB FCC CERTIFICATION
MARCH 14	ENGINEERING RELEASE
MARCH 28	2ND FRED SILICON (IF REQUIRED)
APRIL 18	SAN JOSE TEXTURED HARD TOOLS COMPLETE
	1ST FAR EAST TOOLS COMPLETE AND SHAKEN DOWN

## (CONTINUED)

MAY 2 BEGIN PRODUCTION

JULY 15 2ND FAR EAST TOOL SET ON LINE

AUGUST 15 3RD FAR EAST TOOL SET ON LINE

SEPTEMBER 15 4TH FAR EAST TOOL SET ON LINE

## LOW COST COMPUTER UNRESOLVED ISSUES

- 1. COMMUNCIATIONS
- 2. SOFTWARE SCHEDULE
- 3. SOFTWARE COMPATIBILITY
- 4. EXPANSION CONNECTOR
- 5. ON-BOARD BASIC
- 6. THERMAL
- 7. FRED, RAM, & PORKEY
- 8. BATTERY ELIMINATOR
- 9. SCREEN DUMP
- 10. CONDENSED CHARACTER SET
- 11. PACKAGING AND MANUAL SCHEDULE AND RELATED PRICE OBJECTIVES

### UNRESOLVED ISSUES

#### (CONTINUED)

#### 12. MANUFACTURING ISSUES:

STAGING: WHERE IS IT GOING TO BE BUILT?

HOW MANY DIFFERENT PLACES?

### RELEASE QUANTITIES

16K

32K

48K

64K

13. MATERIAL ACQUISITION ISSUES:

STAGING

CONTRACTURAL GUARANTEES

GUARANTEES FOR RELEASE

- 14. INTERNATIONAL SECAM
- 15. ENTIRE SCHEDULE COULD SLIP 6 WEEKS IF 1ST PASS FRED DOES NOT WORK
- 16. MAY NEED QUICK TURN ROMs FOR O.S.
- 17. TOOLING

BURN-IN OVENS

18. NAME OF PRODUCT

#### \* ATARI COMPICENTIAL \*

#### FIELINGENER'S

Atari 600 Home Computer
Low Cost Computer Specification
Paulaion Oper 9/17/02

Revision One: 9/17/82 Revision Two: 1/07/83

This specification will identify design goals and limitations. The emphasis will be on engineering details and marketing.

#### -Price Goals

.iz:

The price goal for Liz is \$200. The cost of manufacture will be less than \$75. For its price point, Liz has features and capabilities exceeding competitors products.

#### Design Goals:

Liz has a full size keyboard, with full stroke feel. Other features will be the Atari Serial Bus, Atari Custom Video Chips, either a new 16K or the Atari 800 10K ROM Operating System Rev. B, 16K RAM, and the possibility of expansion via card edge fingers accessable at the rear of the unit. The Fred custom chip will make possible a low-cost PAM adaptor, which would include, in an external unit, PAM controller interface, and FAM O/S ROMS.

Major cost reductions will be due to:

- (a) Single P.C. Board construction.
- (b) Greater circuit integration, reducing the total chip count to 9 LSI.
- (c) Less memory space decoding while allowing unlimited memory expansion by external circuitry.
- (d) Simple packaging, fewer connectors, fewer parts.
- (e) Low-Cost keyboard.

Introduction and Scope

The purpose of this document is to detail the engineering design specifications and the engineering performance specifications for the Atari 600 Home Computer. The Atari 600 is a low cost personal computer intended for use in a domestic environment. The Atari 600 is an enhanced version of the Atari 800 computer system. It is reduced in size, lower in price and upward compatible

It is reduced in size, lower in price and upward compatible with the Atari  $800 \, \cdot \,$ 

The Atari 600 has been referred to as the Liz, Crazy 8, and S-8 in other documents.

#### Relevant Documents

Marketing Requirements Statement: Low Cost CFU #A-SE-05-82-5-0

Atari 800 Hardware Manual (CO16555)

Serial Input/Output Interface Ace Under's Handbook Part 1 &

De Re Atari

Electrical Requirements for the Liz Keyboard

Liz Schematics

The 6502 Microprocessor Manual

MC68B21 (PIA) Data Sheets

Preliminary Atari 600 Keyboard Specification.

6502 Software Design Manual

6502 Modified Electrical Specifications (CO14806)

MTBF Calculations for Atari 800/400 by Steve Zyski (HCD QA Document)

Electrical Details of Atari Custom Chips (uncontrolled documents)

#### Product Overview

Liz is an 8 bit CPU with the design emphasis on cost reduction. Its design is to extend the Atari home computer product line offering a low-cost, entry level CPU. It will

offer Atari's high quality graphics and sound and will take advantage of Atari's growing software base.

The Atari 600 in comparison with the Atari 1200

The Atari 600 external features differ from those of the Atari 800 in the following areas:

- 1. Lower profile than the Atari 1200.
- 2. Much smaller package.
- 3. Function keys and status LEDs deleted.
- 4. An interface to the CPU bus (called the Parallel Bus Interface, PBI) has been added. In addition to the standard serial bus interface.
- 5. The exteral power supply.
- 6. The single cartridge slot is on the top (behind the keyboard) instead of the side.
- $7_{\,\circ}$  The 5 pin DIN connector for the monitor interface has been deleted.
- 8. Use of Custom LSI to reduce parts count.

Internally the Atari 600 further integrates a single logic board. A custom LSI integrated circuit (Fred) replaces most of the discreet semiconductors required by the 1200 to achieve cost reduction goals and improve manufacturability, reliability and performance.

Externally, the package is two piece, top and bottom housing, for simple assembly and low cost.

The architecture of LIZ is similar to that of the A800 and A1200, with a few significant differences.

The heart of the unit is still the modified 6502 microprocessor Sally.

Later versions of the LIZ unit will have the Antic and GTIA chips integrated into one LSI chip. Until this integration is performed, the display circuits will utilize the standard Antic and GTIA chips.

 $\rm I/O$  processing is handled similarly to the A800 and A1200. Porky and a 6520 are used for serial bus and controller interfacing. Keyboard scanning is also performed by the Porky chip, while some PBI handshacking is handled by the PIA(6520).

#### Memory Configurations

The Atari 600 will be available in two configurations:

- 1. A 16K Atari 600 (a 600 with 16K of system RAM).
- 2. A 64K Atari 600 (a 600 with 64K of system RAM).

Upgrade of the 16K to a 64K unit is possible by adding memory chips and an address decoder chip.

Other than memory size, the two versions of the Atari 600 will be identical. The 64K RAM version can use 64K X 1 DRAMs for further cost reduction.

#### Architecture Overview

The architecture of the Liz Computer is similar to that of the Atari 800. Figure XX shows the basic functional blocks.

The 6502 microprocessor (Atari part #C014806) is used as the central processing unit (CPU).

The memory, the I/O processing circuitry, the display circuitry, the PBI and the cartridge lie within the memory map of the CPU.

The CFU can address these functional blocks and exchange conrol/status informaton and/or data with them.

The operating system of the Liz computer (described in Chapter 6)

controls information exchange between all entities on the  $\mathsf{CPU}$  bus.

The video display generation circuitry consists of ANTIC, the GTIA, and associated circuitry. ANTIC is a custom microprocessor with an instruction set geared towards display processing (alphanumeric and graphic). This is the only device in the 600 that can halt the CPU and become a master on the CPU bus. ANTIC does this to retrieve display commands from a shared

data base in the CPU memory.

ANTIC translates the high level CPU commands to a simple bit stream for the GTIA.

The GTIA adds color and "player missle" graphics to the input bit stream and provides outputs suitable for display. The ANTIC and GTIA interfaces directly to the processor bus in addition to interfacing with each other.

The  $\rm I/O$  circuitry consists of the Porkey  $\rm I/O$  chip, the  $\rm 6502$  Peripheral Interface Adapter (PIA) and miscellaneous circuitry.

The Porky and PIA together control the SIO interface and the controller interfaces.

The Porky also performs keyboard scanning while the PIA generates control signals for the PBI. Certain parts of the GTIA are also used to I/O contrl.

The Operating System ROM houses the Atari 500 operating system.

One 16K X8 ROM is used for this purpose. These ROMs can be disabled via the Fred chip, under program control, and a different 0.8. can be loaded from peripherals (e.g. disks).

The System Memory consists of up to 64K bytes of Dynamic Random Access Memories (DRAMs).

The Cartridge Interface accepts standard Atari cartridges, which can occupy XXXX-XXXX

The Controller Interface hosts user input devices such as joysticks and paddles.

The SIO Interface provides an interface for intelligent serial peripherals like disks, cassettes and printers. Several peripherals can be daisy chained on this interface.

The Parallel Bus interface (PBI) provides an interface for additional memory and memory mapped.

The Keyboard is XX key full stroke QWERTY typewriter style keyboard with 66 keys with 10 function keys (including a HELP key) and a RESET key.

The Liz computer Power Supply is an external "battery eliminator" type power supply. It takes 115 Vac as nominal input voltage and produces supply current for the Atari 600 electronics. disks).

#### PEC Specifications

The specification for the Parallel Bus Connector (PBC) are defined in a seperate document. A preliminary pinout for the connector is attached.

#### Keyboard Interface

The same as the A1200, A800, etc.—with Fewer keys than the A1200.
The switch matrix for the keyboard must be different to accommodate the further integration of Pokey in the Porky chip.

#### Controller Interface

Same as the A1200.

#### Cartridge Interface

Same as the left cartridge on the A800, with passive chip selects disable of RAMS.

#### T.V. Interface

Same as the A1200, with RF modulated output as well as composite output for a video monitor.

#### Digital Logic

6502 CPU - wiil be the same as SALLY, the custom 6502.

Memory Map - Liz will initially use the 10K ROMS (operating system) of the A800. This means that no software is required, and the unit will run 800/800 software. A major design goal is to have software compatibility with existing Atari products.

RAM - 000 to 3FFFH (16K)

ROM - D800 to FFFF

I/O - D000-D7FF

Cartridge - A000-BFFF

SPARE - 4000-9FFF, C000-CFFF

There is no self test mode for the LIZ, as in the A1200, but the ROM can be disabled by the PBC. There is also no cartridge control, only 4 parts of the I/O space are decoded.

Antic chip — his chip is explained in the other literature available (A1200 and A800 specs.).

GTIA chip - same as Antic.

 $\underline{\text{PIA chip}}$  - Controller inputs are the same as for the A1200 and the A800.

Part 8 pins are as yet undefined

The rest of the pins are as defined as in the  $\mathrm{A1200}$  specs.

<u>Porky chip</u> - functionally the same as Pokey, with CMOS multiplexers integrated on-chip. See Porky specification.

Memory - 16K X 4 DRAMS and 64K X 1 DRAMS may be used (different PCBs are required to accommodate the two types). All multiplexing, timing and control signals are generated by the Fred chip. RAS and CAS are generated as in the 800.

#### AC Line Interface

The AC line input to the power supply should have the following characteristics:

V=100 Vac (min) 130 Vac (Max) F=60 Hz  $\pm$  10 cycles

#### R.F. Modulator

The R.F. Modulator inputs the composite video and the monoaural audio signals from the video summation circuitry and produces a modulated signal suitable for the television. A channel selection switch is provided to allow the user to use either TV channel 2 or channel 3 with the S-16.

The modulated signal will have the following caracteristics with a 75ohm termination:

Maximum Voltage: 2mV Minimum Voltage: 1mV

#### The Atari 600 Memory

#### O.S. ROMs

The 600 0.8. is resident in one 16K X 8 ROM that is located in address space COOOH to FFFH in the CPU Memory Map.

The ROMs input CPU address lines AO thru A12 and the chip selects from the Fred Chip and generates data on CPU Data Lines.

(D0 thru D7).

The ROMs require a power input of  $5 \lor (\pm 5\%)$ .

#### Dynamic RAMs

The Atari 600 Random Access Memories can be either 8-64K X 1 DRAMs or 2 to 8 16K X 4 DRAMs.

The DRAMs in a 16K S-16 reside in addressed 0000H thru  $3 \text{FFFH}_{\star}$ 

The DRAMs in the 64K S-16 can physically occupy the entire address space of the CPU.

Generation of ROW and COLUMN addresses and other control signals are provided by the Fred Chip.

#### The TV Interface

The 600 provides an RF Modusted output for direct connection to a TV set.

The RF output is available through a phono plug located on the back of the S-16.

A channel selection is provided on the left side of the S-16. The user may use TC channels 2 or 3 with the S-16.

Direct connection to Audio and Video inputs and outputs are available at the PBC connector. External Video and Audio inputs may thus be applied and will appear on the television screen (or at the speaker). External Video Monitors and Audio Amplifiers may be interfaced via the PBC.

#### Mechanical Details

To be specified.

#### Controller Interfaces

The S-16 provides two controller jack interfaces. Both are functionally and electrically identical. The controller jacks are 9 pin D type male connectors with the following signals:

(see figure XX)

PIN 1 thru PIN 4 are general purpose I/O lines. Each of these lines' direction is individaully programmable by writing into the PIA internal registers.

When a joystick is connected to the controller jacks, these lines are the FWD (forward), BACK, LEFT and RIGHT inputs respectively providing direction control inputs to the S-16.

See (1) and (7) for a discussion on the direction control mechanism for these lines.

(1) also describes the configuration of these lines when other input devices such as paddles are connected 4.0

these lines.

PIN 5 and 9 are BPOT input and APOT input resectively. These inputs accept the outputs from the potentiometers in the two paddles that can be connected to te controller interfaces.

PIN 6 is the "active low" TRIGGER input from the controllers (eq. joysticks, paddles).
These inputs are also desgned to accept the light pen signal.
When this line goes low the GTIA LP (Light Pen) Input is pulled low.
See section 5.2.1.3.3 and (1) for detals.

PIN 7 is the Vcc output to the controllers. This power output has nominal value of 5 Vdc.

FIN 8 is the GROUND reference for the controllers.

#### Electrical Levels

PINS 1 through PIN 4 are buffered inputs in parallel with ratioed outputs (with static protection circuitry) and have the following electrical characteristics:

Input 0 level ---> -0.5Vdc (min) :::: 0.8Vdc (max)

Input 1 level ---> 2.0Vdc (min) :::: (max)

Output 0 level at 1.6mA ---> VSS (min) :::: 0.4Vdc (max)

Output 1 level at -100microamp ---> 2.4 Vdc (min) :::: Vcc (max)

Capacitance ---> 15pF

Load Current at 2.4Vdc ---> 100 microamps

PINS5 and 9 are schmitt Trigger inputs with a low threshold of 1 Vdc (max) and a high threshold of 1.7 Vdc (min) and a hysterisis of 0.3 Vdc (min). The input capacitance is 15 pF.

PIN 6 has the following electrical characteristics:

Logic 0 input Level ---> 0.8 Vdc (max)

Logic 1 Input Level ---> 2.0 Vdc (min)

Input capacitance ---> 15 Pf

#### The Cartridge Interface

The cartridge interface is a 30 pin 15/30 Dual Readout connector (figure 5.2.11) with the following pin-out:

PIN 1 is the S4 Select output to the cartridge. This line goes low if the RD4 input (PIN A) and RDS (PIN 14) are active and an address between A000H and BFFFH is invoked on the CPU bus.

PIN 12 is the S5 Select output to the cartridge. This line goes low if the RD5 input (PIN 14) is active and an address between 8000H amd 9FFFH is invoked on the CPU bus.

PIN A is the RD4 input from the cartridge. If a cartridge uses addresses between A000H and BFFFH it should pull this line high internally. When this line is pulled high the S-16 maps the addresses A000H thru BFFFH to the cartridge.

PIN 14 is RDS input from the cartridge.
If a cartridge uses addressed A000H to BFFFH it should pull
this line high internally.
The S-16 O.S. polls this line to sense a cartridge.
If this line is sensed high the S-16 maps the addresses
between 8000H and 9FFFH to the cartridge.

PIN 15 is the Cartridge Control (CCNTL) output to the cartridge.
This output is pulled low if the RDS is bigh and an add

This output is pulled low if the RD5 is high and an address of the form D5XXXH is invoked on the CPU bus.

PIN S is the Buffered Phase 2 (802) output to the cartridge. The cartridge may use this clock for its internal timing.

PIN R is the CPU Read/Write output to the cartridge from the CPU.

PINs 5,4,3,2,C,D,E,F,H,J,P,N,K, are CPU Address Outputs AU thru A12 respectively to the cartridge. The CPU can address an 8K byte segment of memory resident in the cartridge using these lines.

PINs 10, 9, 8, L, 6, 7, 11, M are the CPU data lines D0 thru D7 respectively.

PIN 13 is the Vcc pin with a nominal voltage of 5Vdc.

PIN B is the GROUND reference to the cartridge.

#### Electrical Levels

The address Outputs (AO thro A12), the Data Lines (DO thro D7) during a CPU write cycle, the R/W output and the BO2 Output have the following drive capability:

HIGH STATE: V=2.7~Vdc (min); I=20~microsmps (min source current).

LOW STATE: V=0.5 Vdc (max); I=0.36 mA (max sink current).

The CCNTL Output, and the Select Lines S4 and S5 have the following drive capability:

HIGH STATE: V=2.7 Vdc (min); I=400 microsmps (min source current)

LOW STATE: V=0.5 Vdc (max); I=8 mA (max sink current).

The RD4 and RD5 inputs and the data lines (D0 thru D7) during a CPU read cycle should have the drive capability of at least one LSTTL gate.

#### Package and Appearance

Dimension and Weight

Height - 2.7 inches; Width - 15 inches; Dept - 12.5 inches; Weight - to be specified.

Package Description

Position of Connectors

Keyboard Description

The Atari S-16 Home Computer has a full stroke QWERTY typewriter style keyboard similar in layout to the Atari 800 Home Computer keyboard. The board has 54 alphanumeric keys (including special characters and controls), a space bar, and 11 function keys.

In addition to the alphanumeric keys, the board as a

CONTROL key, for Control functions, input of Graphics characters and Cursor Control. The board also has a CAPS lock key. A SHIFT key is located on each side of the board near the SPACE bar.

Above the typewriter pad is a series of 11 function keys. The tops of these keys are level with the bezel, but depress below bezel to provide the same tactile feel as te alphnumeric keys..ll Included in the function keys are START, SELECT, OPTION, the ATARI Logo Key and the BREAK key. At the far left of this strip of keys is the RESET key.

The four remaining Function Keys, F1 thru are user programmable.

There is a label panel directly above the Function Keys. This panel contains one LED (in the case of the 16K version) or three LEDs (in the case of the 64K version). It also contains the key labels for the Function Keys.

On the 16K version of the Atari S-16 Home Computer, the strip is a contination of the keyboard bezel and is made of the same material as the housing.

There is one LED which is used as a FOWER ON indicator.

The 64K version of the Atari S-16 Home Computer has a label strip made of plexiglas. There are three LEDs, one of which is the POWER ON indicator; the other two LEDs are activated as specified in Chapter 6. The key labels are hot stamped on to bezel underneath the strip.

The keyboard is connected to the mother board by a 15-conductor ribbon cable terminating in a Molex 22-01-2156 connector.

This connector is polarized so that it can be connected in only one way. See "S-16 Keyboard

Electrical
Requirements" (Atari P/N CO60087) and Keyboard
Assembly Drawing (CO40046) for complete details of
electrical
parameters.

#### Package Colors

The keyboard and bezel is dark brwn (Borg Warner Cycloac #T84816).

The plexiglas strip above the function keys on the 64K version is translucent brown. The strip above the function keys on the 16K version is the same color as the housing.

#### Environmental Requirements

Temperature range: 0 to 40 degrees Centegrade.

The housing is white (Borg Warner Cycloac #KJW86006).

#### Package Materials

The keyboard and housing is made of ABS plastic.

The keytops of the Function Keys are brushed and formed aluminum nameplate material.

#### SIO Performance

MAX BAUD RATE 19.2K BAUD

Motor Start line with 180 ohm should pull up to (Vec-0.2) Volts when "ON".

#### R.F. Modulator Performance

The R.F. Iddulator will have the following characteristics with the  $75~\mathrm{Ohm}$  termination:

Maximum Voltage: 2mV Minimum Voltage: 1mV

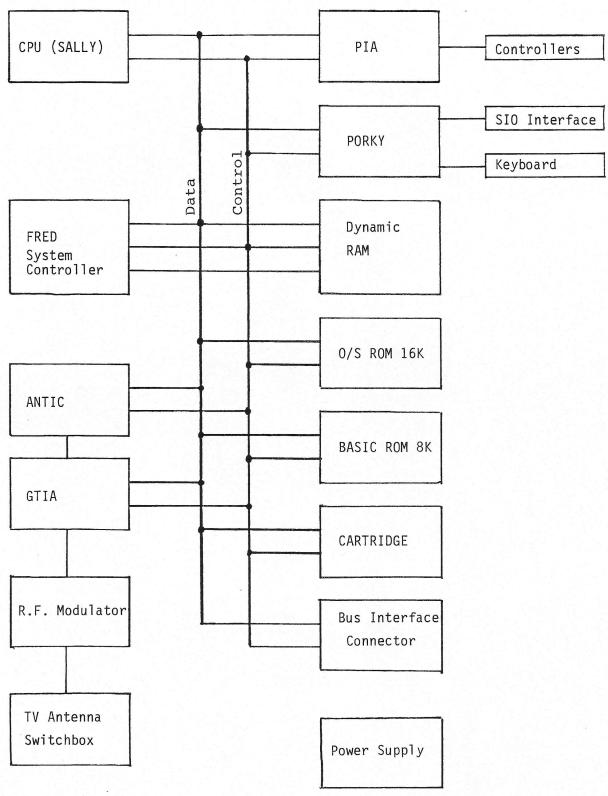
The Modulator output is selectable via a switch (on the left side of the S-16) to Channel 2 or Channel 3.

#### Monitor Jack Performance

Composite video and composite liminance outputs will have the following characteristics with a 75 ohm termination: SYNC TIP (MAX) 0.08 V BLACK LEVEL 0.35 V $\pm$  10% WHITE LEVEL 0.7V  $\pm$  15%

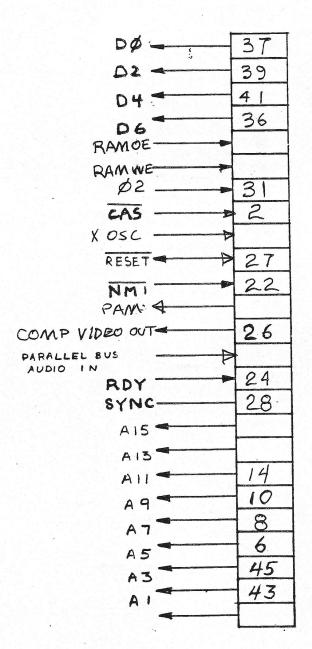
Audio Outputs will have the following caracteristics:
Frequency Range: 100Hz to 100KHz

ATARI 600 Computer System Block Diagram

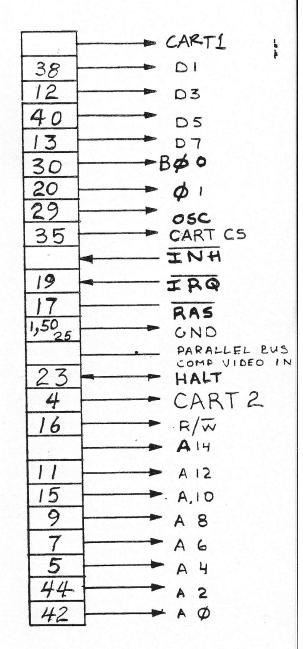


Total on-board memory: 88K in 64K RAM version

## Preliminarg Parallel Bus



4



Pin Assignments not firm

NorthWest Design Products Inc.

B

2

CRAZY 8: PARTS COST SUMMARY\*
VERSION DATE: JANUARY 7, 1983

ITEM	QUANTITY	COST
RESISTORS CAPACITORS CONNECTORS PC BOARD	71 43 38 1	.368 2.829 4.202 6.6
CUSTOM ICs ***FRED	1	3.85
***FRED  ***PORKY  ***SALLY  ***ANTIC  ***GTIA  ***BASIC ROM  ***RUFUS  OTHER ICs  MISC. ELECT.  KEYBOARD  OTHER MECH  PWR ADAPTOR	1 1 1 1 1 8 1 122 1 9	2.5 3.25 3.57 2.54 2.5 5.8 12.471 2.8602 8 3.576 3.41
OTHER PKOUT		3.63
TOTALS (16K)	311	71,9562

PLUS: DUTIES, SHIPPING, OVERHEAD, AND LABOR (.55 HOURS FINAL ASSEMBLY AND TEST)

<sup>\*</sup> REVISED VERSION ON 1/14/83

# PART # BUANTITY UNIT COST T  14-5101 2 .0034  14-5182 5 .0034  14-5182 11 .0034  14-5102 11 .0034  14-5102 11 .0034  14-5102 11 .0034  14-5103 3 .0034  14-532 1 .0034  14-532 1 .0034  14-532 1 .0034  14-532 1 .0034  14-533 1 .0034  14-5104 3 .0034  14-5105 1 .0034  14-5104 1 .0034  18D 2 .0034	RESISTORS						RESISTORS	
2 .0034 .0058 1000fm, 25M, 5X R35 1 .0034 .0034 .2068 1000fm, 25M, 5X R35 1 .0034 .0034 .0034 .206m, 25M, 5X R47 5 .0034 .0034 .0034 .47k, 25M, 5X R41, 57, 63, 64 13 .0034 .0442 .47k, 25M, 5X R3, 81, 51, 51-53, 55-59, 62, 69 11 .0034 .0102 10k, 25M, 5X R12, 19, 15, 12-1-33, 55-59, 62, 69 2 .0034 .0102 10k, 25M, 5X R22 1 .0034 .0102 10k, 25M, 5X R65 1 .0034 .0034 .034 2.2k, 25M, 5X R22 1 .0034 .0034 .0034 2.2k, 25M, 5X R22 1 .0034 .0034 .0034 2.2k, 25M, 5X R22 2 .0034 .0034 .0034 .27k, 25M, 5X R22 3 .0034 .0034 .0034 .27k, 25M, 5X R22 1 .0034 .0034 .0034 1.5k, 25M, 5X R22 2 .0034 .0034 .0034 1.5k, 25M, 5X R23 1 .0034 .0034 .0034 1.5k, 25M, 5X R23 2 .0034 .0034 .0034 1.5k, 25M, 5X R23 1 .0034 .0034 .0034 1.5k, 25M, 5X R13 1 .0034 .0034 .0034 1.5k, 25M, 5X R13 1 .0034 .0034 .0034 1.5k, 25M, 5X R13 1 .0034 .0034 1.5k, 25M, 5X R13 1 .0034 .0034 1.5k, 25M, 5X R23 1 .0034 .0034 1.5k, 25M, 5X R33 1 .0034 .0034 1.5k, 25M,	ITEN #	PART #	QUANTITY	UNIT COST	TOTAL COST	DESCRIPTION	DESIGNATION	NOTES/SOURCE
1		14-5101	c	#2.00	9700	1000t	17 650	
1 .0034 .0034 4700ha, 25h, 5x RA3		TOTE LE	4 +	4200	4200	DATE OF EN	N32, 34	REDIDI. PRICES
1 .0034 .0034 .1003		001		1000	+500.	40 WD7 • WIII / 7	A58	BY M.SIKUIZEL, VAL PRUJ.
5 .0034 .017 1.8K,.25W,5X R4,1b,39,63,64 13 .0034 .0042 4.7K,.25W,5X R3,821,51-53,55-59,62, 11 .0034 .0374 1K,.25W,5X R3,821,51-53,55-59,62, 2 .0034 .0102 10K,.25W,5X R2,7,11 2 .0034 .0102 118K,.25W,5X R2,7,11 2 .0034 .0102 118K,.25W,5X R2,028 1 .0034 .0034 .2.K,.25W,5X R2,028 1 .0034 .0034 .2.K,.25W,5X R2,03 1 .0034 .0034 .2.K,.25W,5X R2,03 1 .0034 .0034 .2.K,.25W,5X R2,03 1 .0034 .0034 .1K,.25W,5X R3,03 1 .0034 .0034 .15K,.25W,5X R13 1 .0034 .0034 .15K,.25W,5X R3,03 1 .0034 .0034 .10K,.25W,5X R50		14-54/4	•	. 0034	.0034	470ohm, .25W, 5%	R47	
13 .0034 .0442 4.7K,.25W,5X R3,8,21,51-53,55-59,62,  11 .0034 .0374 1K,.25W,5X R1,5,9,15,42-4660,61  3 .0034 .0374 1K,.25W,5X R2,7,11  7 .0034 .0102 10K,.25W,5X R2,7,11  8 .0034 .0102 118K,.25W,5X R2  1 .0034 .0034 3.3K,.25W,5X R2  1 .0034 .0034 2.2K,.25W,5X R2  2 .0034 .0034 2.2K,.25W,5X R2  1 .0034 .0034 2.2K,.25W,5X R2  3 .0034 .0034 2.2K,.25W,5X R2  1 .0034 .0034 3.9K,.25W,5X R25  3 .0034 .0034 1M,.25W,5X R25  1 .0034 .0034 1,000,25W,5X R33  2 .0034 .0034 1,5K,.25W,5X R13  1 .0034 .0034 1,5K,.25W,5X R13  1 .0034 .0034 1,5K,.25W,5X R13  1 .0034 .0034 1,2K,.25W,5X R23  2 .0034 .0034 1,2K,.25W,5X R23  1 .0034 .0034 3,8K,.25W,5X R53  2 .0034 .0034 3,8K,.25W,5X R50  1 .0034 .0034 3,8K,.25W,5X R48		14-5182	co.	.0034	.017	1.8K,.25W,5%	R4, 16, 39, 63, 64	
11 .0034 .0374 1K,.25W,5% R1,5,9,15,42-4660,61 3 .0034 .0102 10K,.25W,5% R2,7,11 2 .0034 .0102 10K,.25W,5% R2,7,11 3 .0034 .0102 18K,.25W,5% R6 2 .0034 .0102 18K,.25W,5% R6 2 .0034 .0034 3.3K,.25W,5% R2 1 .0034 .0034 3.3K,.25W,5% R2 2 .0034 .0034 2.2K,.25W,5% R2 3 .0034 .0034 3.5K,.25W,5% R2 1 .0034 .0034 3.5K,.25W,5% R2 2 .0034 .0034 3.5K,.25W,5% R2 3 .0034 .0034 11M,.25W,5% R2 3 .0034 .0034 1.5K,.25W,5% R2 1 .0034 .0034 1.5K,.25W,5% R13 1 .0034 .0034 3.5K,.25W,5% R13 1 .0034 .0034 3.5K,.25W,5% R13 1 .0034 .0034 3.5K,.25W,5% R83 2 .0034 .0034 3.5K,.25W,5% R83 1 .0034 .0034 3.5K,.25W,5% R48 1 .0034 .0034 3.5K,.25W,5% R48		14-5472	13	.0034	.0442	4.7K,.25W,5%	R3, 8, 21, 51-53, 55-59, 62, 69	
14-5103         3         .0034         .0102         10½, 25¼,52         R277,11           18D         7         .0034         .0102         18K, 25¼,52         R40,41,65-68,70           14-5183         3         .0034         .0102         18K, .25¼,52         R6           14-5322         1         .0034         .0034         .0034         .5.6K, .25¼,52         R6           14-5322         1         .0034         .0034         .0034         .2.2K, .25¼,52         R6           14-5322         1         .0034         .0034         .0034         .2.2K, .25¼,52         R2           14-532         1         .0034         .0034         .0034         .2.2K, .25¼,52         R2           14-532         1         .0034         .0034         .0034         .2.2K, .25¼,52         R2           14-532         1         .0034         .0034         .0034         .004         .8         .2.2K, .25¼,52         R2           14-532         1         .0034         .0034         .004         .8         .7         .55½,52         R2           14-5104         3         .0034         .0034         .004         .8         .7         .55½,52 <td< td=""><td></td><td>14-5102</td><td>=</td><td>.0034</td><td>.0374</td><td>1K, .25W, 5%</td><td>R1,5,9,15,42-4660,61</td><td></td></td<>		14-5102	=	.0034	.0374	1K, .25W, 5%	R1,5,9,15,42-4660,61	
TBD		14-5103	м	.0034	.0102	10K, .25W, 5%	R2,7,11	
14-5183       3       .0034       .0102       18K,.25W,52       R6         14-5332       1       .0034       .0034       3.3K,.25W,52       R6         14-5332       1       .0034       .0048       9.1K,.25W,52       R20,28         14-522       1       .0034       .0034       2.2K,.25W,52       R18         14-5323       1       .0034       .0034       2.2K,.25W,52       R22         14-5353       2       .0034       .0034       3.50hm,.25W,52       R22         14-537       1       .0034       .0034       3.9K,.25W,52       R25         14-5392       1       .0034       .0034       1002       350hm,.25W,52       R25         14-5104       3       .0034       .0034       1002       100K,.25W,52       R25         14-5104       3       .0034       .0034       1.5K,.25W,52       R13         18D       1       .0034       .0034       1.5K,.25W,52       R14         18D       1       .0034       .0034       12K,.25W,52       R14         18D       1       .0034       .0034       12K,.25W,52       R14         18D       1       .0034       .0034 </td <td></td> <td>TBD</td> <td>7</td> <td>.0034</td> <td>.0238</td> <td>180</td> <td>R40,41,65-68,70</td> <td></td>		TBD	7	.0034	.0238	180	R40,41,65-68,70	
1 .0034 .0034 3.3K,.25W,52 Rb 2 .0034 .0068 9.1K,.25W,52 R18 1 .0034 .0034 2.2K,.25W,52 R18 1 .0034 .0034 2.2K,.25W,52 R18 2 .0034 .0034 3.6K,.25W,52 R22 3 .0034 .0034 3.9K,.25W,52 R22 1 .0034 .0034 1M,.25W,52 R25 2 .0034 .0034 1M,.25W,52 R25 1 .0034 .0034 1.5K,.25W,52 R33 1 .0034 .0034 1.5K,.25W,52 R13 1 .0034 .0034 1.5K,.25W,52 R13 1 .0034 .0034 12K,.25W,52 R13 1 .0034 .0034 470K,.25W,52 R23 2 .0034 .0034 3K,.25W,52 R25 1 .0034 .0034 3K,.25W,52 R50 1 .0034 .0034 3K,.25W,52 R50 1 .0034 .0034 3K,.25W,52 R50 1 .0034 .0034 3K,.25W,52 R83		14-5183	м	.0034	.0102	18K, 25W, 5Z	R12,19,71	
14-5912       2       .0034       .0068       9.1K,.25W,5X       R20,2B         14-5222       1       .0034       .0034       2.2K,.25W,5X       R1B         14-5233       1       .0034       .0034       36K,.25W,5X       R22         14-5331       3       .0034       .0034       37K,.25W,5X       R24,30,31         14-5392       1       .0034       .0034       1002       37K,.25W,5X       R25         14-5104       3       .0034       .0034       1002       100K,.25W,5X       R24,35,3B         14-5104       3       .0034       .0102       100K,.25W,5X       R24,35,3B         14-5104       3       .0034       .0102       100K,.25W,5X       R25         14-5105       1       .0034       .0034       1.5K,.25W,5X       R33         1BD       1       .0034       .0034       1.5K,.25W,5X       R13         1BD       1       .0034       .0034       15K,.25W,5X       R14         1BD       1       .0034       .0034       12K,.25W,5X       R14         1BD       1       .0034       .0034       12K,.25W,5X       R37         1BD       1       .0034		14-5332	-	.0034	.0034	3.3K, 25W, 5%	R6	
14-5222       1       .0034       .0.2x, .25w, 5x       R1B         14-5363       1       .0034       .0034       36k, .25w, 5x       R22         14-5363       1       .0034       .0034       .0034       .56k, .25w, 5x       R22         14-5392       1       .0034       .0034       .0034       .0034       .0034       .0034       .0034       .0034       .0034       .0034       .0034       .0034       .0034       .0034       .0034       .0034       .0034       .0034       .0048       2.7k, .25w, 5x       R24, 35, 38         14-5104       3       .0034       .0048       2.7k, .25w, 5x       R24, 35, 38         14-5104       3       .0034       .0048       2.7k, .25w, 5x       R33         18D       1       .0034       .0054       .15k, .25w, 5x       R14         1BD       1       .0034       .0034       .12k, .25w, 5x       R17         1BD       1       .0034       .0034       .470k, .25w, 5x       R37, 49         1BD       1       .0034       .0034       .20k, .25w, 5x       R48         1BD       1       .0034       .0034       .20k, .25w, 5x       R48         1BD <td></td> <td>14-5912</td> <td>2</td> <td>.0034</td> <td>8900</td> <td>9.1K,.25W,5%</td> <td>R20,28</td> <td></td>		14-5912	2	.0034	8900	9.1K,.25W,5%	R20,28	
14-5363       1       .0034       .0034       36k,.25w,5x       R22         14-5331       3       .0034       .0102       330nm,.25w,5x       R24,30,31         14-5392       1       .0034       .0034       3.9k,.25w,5x       R27         14-5105       1       .0034       .0034       1M,.25w,5x       R25         14-5104       3       .0034       .0034       .0034       R24,35,38         14-5104       3       .0034       .0048       2.7k,.25w,5x       R24,35,38         18D       1       .0034       .0034       1.5k,.25w,5x       R33         18D       1       .0034       .0034       1.5k,.25w,5x       R14         18D       1       .0034       .0034       12k,.25w,5x       R14         18D       1       .0034       .0034       470k,.25w,5x       R37         18D       1       .0034       .0034       470k,.25w,5x       R37         19-41504       1       .0034       .0034       3k,.25w,5x       R36         18D       1       .0034       .0034       3k,.25w,5x       R48		14-5222	-	.0034		2.2K,.25W,5%	R18	
14-5331       3       .0034       .0102       330ahm, 25W,57       R26,30,31         14-5392       1       .0034       .0034       3.9K, 25W,57       R27         14-5105       1       .0034       .0034       10K, 25W,57       R25         14-5104       3       .0034       .0034       10K, 25W,57       R24,35,38         14-5104       3       .0034       .0048       2.7K, 25W,57       R24,35,38         18D       1       .0034       .0034       1.5K, 25W,57       R33         1BD       1       .0034       .0034       1.5K, 25W,52       R13         1BD       1       .0034       .0034       15K, 25W,52       R14         1BD       1       .0034       .0034       12K, 25W,52       R14         1BD       1       .0034       .0034       12K, 25W,52       R23         1BD       1       .0034       .0054       220K, 25W,52       R57, 49         1BD       2       .0034       .0054       3K, 25W,52       R59         1BD       1       .0034       3K, 25W,52       R59         1BD       1       .0034       3K, 25W,52       R65		14-5363		.0034		36K, .25W, 5%	R22	
14-5392       1       .0034       3.9K, 25W,5X       R27         14-5105       1       .0034       .0034       1M, 25W,5X       R25         14-5104       3       .0034       .0102       100K, 25W,5X       R25         14-5104       3       .0034       .0102       100K, 25W,5X       R25         14-5104       3       .0034       .0034       .0034       R25, 25W,5X       R83         18D       1       .0034       .0034       15K, 25W,5X       R13         1BD       1       .0034       .0034       12K, 25W,5X       R13         1BD       1       .0034       .0034       12K, 25W,5X       R14         1BD       1       .0034       .0034       12K, 25W,5X       R23         1BD       1       .0034       .0034       12K, 25W,5X       R23         1BD       1       .0034       .0034       12K, 25W,5X       R23         1BD       2       .0034       .0048       220K, 25W,5X       R50         1BD       1       .0034       .0034       3K, 25W,5X       R48		14-5331	м	.0034		330ahm, .25W, 5%	R26,30,31	
14-5105       1       .0034       .0034       1M,.25M,52       R25         14-5104       3       .0034       .0102       100K,.25W,52       R24,35,38         14-5272       2       .0034       .0034       2.7K,.25W,52       R33         TBD       1       .0034       .0034       1.5K,.25W,52       R13         TBD       1       .0034       .0034       15K,.25W,52       R13         TBD       1       .0034       .0034       12K,.25W,52       R14         TBD       1       .0034       .0034       12K,.25W,52       R14         TBD       1       .0034       .0034       12K,.25W,52       R14         TBD       1       .0034       .0034       470K,.25W,52       R23         TBD       1       .0034       .0034       470K,.25W,52       R50         TBD       1       .0034       .0048       220K,.25W,52       R50         TBD       1       .0034       .0034       3K,.25W,52       R48		14-5392	-	.0034	.0034	3.9K,.25W,5%	R27	
14-5104       3       .0034       .0102       100K, .25W,5Z       R24,35,3B         14-5272       2       .0034       .0048       2.7K, .25W,5Z       R29,54         TBD       1       .0034       .0034       1.5K, .25W,5Z       R33         TBD       1       .0034       .0034       15K, .25W,5Z       R10         TBD       1       .0034       .0034       12K, .25W,5Z       R14         TBD       1       .0034       .0034       91K, .25W,5Z       R14         TBD       1       .0034       .0034       91K, .25W,5Z       R23         TBD       1       .0034       .0034       91K, .25W,5Z       R23         TBD       1       .0034       .0034       91K, .25W,5Z       R50         TBD       1       .0034       .0048       220K, .25W,5Z       R50         TBD       1       .0034       .0034       3K, .25W,5Z       R48		14-5105	-	.0034	.0034	1M, .25W,5%	R25	
14-5272       2       .0034       .0048       2.7K,.25W,52       R29,54         TBD       1       .0034       .0034       1.5K,.25W,52       R33         TBD       1       .0034       .0034       15K,.25W,52       R10         TBD       1       .0034       .0034       15K,.25W,52       R14         TBD       1       .0034       .0034       91K,.25W,52       R17         TBD       1       .0034       .0034       470K,.25W,52       R23         TBD       2       .0034       .0048       220K,.25W,52       R50         TBD       1       .13       500K,.25W,52       R50         TBD       1       .0034       .0048       220K,.25W,52       R50         TBD       1       .0034       .0048       220K,.25W,52       R50         TBD       1       .0034       .0034       3K,.25W,52       R60		14-5104	m	.0034		100K, .25W, 5%	R24,35,38	
TBD 1 .0034 .0034 1.5K,.25W,5% R33 TBD 1 .0034 6.8K,.25W,5% R10 TBD 1 .0034 .0034 15K,.25W,5% R13 TBD 1 .0034 .0034 12K,.25W,5% R13 TBD 1 .0034 .0034 12K,.25W,5% R14 TBD 1 .0034 .0034 91K,.25W,5% R17 TBD 2 .0034 .0034 470K,.25W,5% R23 TBD 2 .0034 .0034 220K,.25W,5% R37,49 TBD 1 .0034 .0034 3K,.25W,5% R50		14-5272	2	.0034		2.7K, .25W, 5%	R29,54	
TBD 1 .0034 .0034 6.8K,.25W,5X R10 TBD 1 .0034 .0034 15K,.25W,5X R13 TBD 1 .0034 .0034 12K,.25W,5X R14 TBD 1 .0034 .0034 91K,.25W,5X R17 TBD 1 .0034 .0034 470K,.25W,5X R23 TBD 2 .0034 .0034 470K,.25W,5X R23 TBD 2 .0034 .0034 220K,.25W,5X R50 TBD 1 .0034 .0034 3K,.25W,5X R50		TBD	-	.0034		1.5K,.25W,5%	R33	
TBD 1 .0034 .0034 15K,.25W,52 R13 TBD 1 .0034 .0034 12K,.25W,52 R14 TBD 1 .0034 .0034 91K,.25W,52 R14 TBD 1 .0034 .0034 91K,.25W,52 R23 TBD 2 .0034 .0034 470K,.25W,52 R23 TBD 2 .0034 .0048 220K,.25W,52 R50 TBD 1 .0034 .0034 3K,.25W,52 R50		TBD	-	.0034		6.8K,.25W,5%	R10	
TBD 1 .0034 12K,.25W,5% R14  TBD 1 .0034 .0034 91K,.25W,5% R17  TBD 1 .0034 .0034 470K,.25W,5% R23  TBD 2 .0034 .0068 220K,.25W,5% R37,49  19-411504 1 .13 .13 500K,.25W,5% R48		180	-	.0034		15K,.25W,5%	R13	
TBD 1 .0034 .0034 91K,.25W,5% R17 TBD 1 .0034 .0034 470K,.25W,5% R23 TBD 2 .0034 .0068 220K,.25W,5% R37,49 19-411504 1 .13 500K,.25W,5% R50 TBD 1 .0034 3K,.25W,5% R48		TBD	-	.0034	.0034	12K,.25W,5%	R14	
TBD 1 .0034 .0034 470K,.25W,5% R23 TBD 2 .0034 .0068 220K,.25W,5% R37,49 19-411504 1 .13 .13 500K,.25W,5% R50 TBD 1 .0034 3K,.25W,5% R48		TBD	-	.0034	.0034	91K,.25W,5%	R17	
TBD 2 .0034 .0068 220K,.25W,5% R37,49 19-411504 1 .13 .13 500K,.25W,5% R50 TBD 1 .0034 3K,.25W,5% R48		TBD	-	.0034	.0034	470K, . 25W, 5%	R23	
19-411504 1 .13 .13 500K,.25W,5% R50 TBD 1 .0034 .0034 3K,.25W,5% R48		TBD	2	.0034	8900.	220K, 25W, 5%	R37.49	
TBD 1 .0034 3K,.25M,5% R48		19-411504	-	.13	.13	500K, . 25W, 5%		
		180	_	.0034	.0034	3K,.25W,5%		
		TOTAL	. 71		072			

CAPACITORS	CAPACITORS					CAPACITORS
I LEN	PART #	QUANTITY	UNIT COST	TOTAL COST	DESCRIPTION	DESIGNATION
31	CO-14181-03	16	.052	.832	.1mf,+80-20%,Z5U,CER AX C1,8,13,23,32,45	IX C1, 8, 13, 23, 32, 45
32	CO-14181-02	9	.03	.18	.01mf,+80-20%,Z5U,CER	AXC14,15,19,20,25,27,41-44,46,55,56,81
R	CO-14181-01	м	.028	.084	.001mf,+80-20%,75U,CEK	.001mf, +80-20%, Z5U, CERAX C21, 35, 37 ,84-91
34	CO-14181-07	-	.04	40.	.47uf,+80-20%,25U,CER	AX C29
35	CO-14170-02	4	.079	.316	47pf, +80-20%, Z5U, CER A	IX C24,39,82,83
36	CO-10821	1	.081	.081	POLY, 820pf, 5%	C18A
37	CO-14180-03	. 2	.027	.054	.054 100pf, 20%, X7R, CER AX C17, C36	617, 636
38	CO-14179-03	2	.079	.158	10pf, +20%, NPD	C16, C28
39	CO-14179-04	-	.03	.03	33uf, COG	C26
40	CO-14374-02	-	89.	89.	4700uf, ELECTRO, +5-10%	C30
41	CO-14181-05	1	.04	.04	.22uf,20%	631
42	CO-14371	1	.053	.053	10uf, 16V, +50-10%	C33
43	180	-	.049	.049	68pf,	C38
44	TBD	1	.038	.038	15pf,	C40
45	CO-14180-05	-	.081	.081	220pf	
46	TBD	-	.113		.047uf	C22
	TATAL C. 47	24 .		000 6		
	PINIME	24.		479.7		

TEM # PART # QUANTITY UNIT COST TOTAL COST DESCRIPTION   DESIGNATION   DESIGNATION   1	CONNECTOR	CONNECTORS AND SWITCHES	လ				CONNECTORS AND SWITCHES	HES
TBD 1 .78 SERIAL BUSS CONNECTOR 35 CO-14715 1 .31 .31 CONNECTOR, POWER JACK JACCO-14715 1 .31 .31 CONNECTOR, POWER JACK JACCO-10448 2 .28 .56 CONN .9PIN" RT ANG, JST J1, 2 CO-14715 1 .77 .77 CART CONN, 3OPIN J4 .77 CART CONN, 3OPIN J2 .995 .995 CHAN SELECT S1, 2 CO-14386-09 5 .14 .72 SOCKETS, APPIN U2, 7-9, 12 CO-14386-08 2 .1 .2 SOCKETS, APPIN U1, 11 .2 SOCKETS, 16PIN U1, 11 .1 KEYBOARD CONNECTOR U6, U2, O-14386-05 1 .072 .072 SOCKETS, 16PIN U1, 19 .1 .1 .1 KEYBOARD CONNECTOR U6, U2 .79, I2 .77 .77 CO-14386-05 1 .35 .35 PHR SHITCH U1, 19 .77 .77 .77 .77 .77 .77 .77 .77 .77 .7	ITEM #	PART #	QUANTITY	UNIT COST	TOTAL COST	DESCRIPTION	DESIGNATION	
TBD 1.78 SERIAL BUSS CONNECTOR 35  CO-14715 1 .31 .31 CONNECTOR, POWER JACK JA CO-10448 2 .28 .56 CONN, 9PIN"D", RT ANG, JST J1, 2 CO-14715 1 .77 .77 CART CONN, 3OPIN J4 79-5903 1 .125 .125 RCA PHOND JACK, RT ANG J3 C012241 1 .095 .095 CHAN SELECT S1, 2 C0-14386-09 5 .144 .72 SOCKETS, 4OPIN U1, 11 CO-14386-08 2 .1 .2 SOCKETS, 4OPIN U1, 11 CO-14386-05 1 .1 .2 SOCKETS, 16PIN U1, 11 CO-14386-05 1 .1 .1 .1 KEYBOARD CONNECTOR U6, U20 CO-14386-05 1 .072 SOCKETS, 2OPIN (64K ONLY) U23 CO14397-XX 1 .35 .35 PWR SMITCH U14-19 TBD 1 6.6 6.6 PCB, CRAZY B  TOTALS: 39 10.802								
CO-14715 1 .31 .31 CONNECTOR, POWER JACK JA CO-10448 2 .28 .56 CONN, 9PIN*D",RT ANG,JST J1,2 CO-14715 1 .77 .77 CART CONN, 3OPIN J4 79-5903 1 .125 .125 RCA PHOND JACK,RT ANG J3 CO12241 1 .095 CHAN SELECT 51,2 CO-14386-09 5 .144 .72 SOCKETS, 40PIN U2,7-9,12 CO-14386-09 5 .144 .72 SOCKETS, 40PIN U2,7-9,12 CO-14386-03 2 .06 .12 SOCKETS, 16PIN U3,10,21 TBD 1 .1 .1 KEYBOARD CONNECTOR U6,U20 CO-14386-05 1 .072 SOCKETS, 16PIN U14-19 TBD 0 SOCKETS, 18PIN U14-19 TBD 0 SOCKETS, 48PIN U15 TBD 1 6.6 6.6 PCB, CRAZY B	47	TBD	-	.78	.78	SERIAL BUSS CONNECTOR	15	
CO-10448 2 .28 .56 CONN, 9PIN"D", R ANG, JST JJ, Z CO-14715 1 .77 .77 .77 .6AT CONN, 3OPIN J4 79-5903 1 .125 .125 RCA PHONO JACK, RT ANG J3 CO12241 1 .095 .095 CHAN SELECT 51, Z CO12241 1 .095 .095 CHAN SELECT 51, Z CO-14386-09 5 .144 .72 SOCKETS, 40PIN U2, 7-9, 12 CO-14386-08 2 .1 .2 SOCKETS, 2BPIN UJ, 11 CO-14386-03 2 .06 .12 SOCKETS, 16PIN UJ, 11 CO-14386-05 1 .1 .1 KEYBOARD CONNECTOR U6, U20 CO-14386-05 1 .072 SOCKETS, 18PIN UJ4-19 TBD 18 0 SOCKETS, 18PIN UJ3 TBD 1 6.6 6.6 PCB, CRAZY 8 TOTALS: 39 10.802	48	CO-14715	-	.31	.31	CONNECTOR, POWER JACK	36	A.el SHIMI: .15 THIS ITEM
CO-14715 1 .77 .77 CART CONN, 30P1N J4 79-5903 1 .125 .125 RCA PHONO JACK, RT ANG J3 CO12241 1 .095 .095 CHAN SELECT S1, 2 CO-14386-09 5 .144 .72 SOCKETS, 40P1N U2, 7-9, 12 CO-14386-08 2 .1 .2 SOCKETS, 28P1N U1, 11 CO-14386-03 2 .06 .12 SOCKETS, 16P1N U3, 10, 21 TBD 1 .1 .1 KEYBOARD CONNECTOR U6, U2O CO-14386-05 1 .072 .072 SOCKETS, 20P1N (64K ONLY) U23 CO14397-XX 1 .35 .35 PWR SWITCH TBD 18 0 SOCKETS, 18P1N U14-19 TBD 1 6.6 6.6 PCB, CRAZY 8 TOTALS: 39 10,802	49	CO-10448	2	.28	.56	CONN, 9PIN"D", RT ANG, JO	ST 31,2	
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C012241 1 .095 CHAN SELECT 51,2 C0-14386-09 5 .144 .72 SOCKETS, 40PIN U2,7-9,12 C0-14386-08 2 .1 .2 SOCKETS, 28PIN U1,11 C0-14386-03 2 .06 .12 SOCKETS, 16PIN U3,10,21 TBD 1 .1 .1 KEYBOARD CONNECTOR U6,U20 C0-14386-05 1 .072 .072 SOCKETS, 20PIN (64K ONLY) U23 C0-14386-05 1 .35 .35 PWR SWITCH TBD 18 0 SOCKETS, 18PIN U14-19 TBD 1 6.6 6.6 PCB, CRAZY 8 TOTALS: 39 10.802	51	79-5903	-	.125	.125	RCA PHOND JACK, RT ANG	33	
CO-14386-09 5 .144 .72 SOCKETS, 40PIN U2,7-9,12 CO-14386-08 2 .1 .2 SOCKETS, 28PIN U1,11 CO-14386-03 2 .06 .12 SOCKETS, 16PIN U3,10,21 TBD 1 .1 .1 KEYBOARD CONNECTOR U6,U20 CO-14386-05 1 .072 .072 SOCKETS, 20PIN (64K ONLY) U23 CO-14386-05 1 .35 .35 PWR SWITCH TBD 18 0 SOCKETS, 18PIN U14-19 TBD 1 6.6 6.6 PCB, CRAZY 8 TOTALS: 39 10.802	52	C012241	-	.095	.095	CHAN SELECT	51.2	
CO-14386-08 2 .1 .2 SOCKETS, 28PIN U1,11 CO-14386-03 2 .06 .12 SOCKETS, 16PIN U3,10,21 TBD 1 .1 .1 KEYBOARD CONNECTOR U6,U20 CO-14386-05 1 .072 .072 SOCKETS, 20PIN (64K ONLY) U23 CO14397-XX 1 .35 .35 PWR SWITCH TBD 18 0 SOCKETS, 18PIN U14-19 TBD 1 6.6 6.6 PCB, CRAZY 8 TOTALS: 39 10.802	23	CO-14386-0	9 5	.144		SOCKETS, 40PIN	U2,7-9,12	LSI SOCKETED ON V
CO-14386-03 2 .06 .12 SDCKETS, 16PIN U3,10,21 TBD 1 .1 .1 KEYBOARD CONNECTOR U6,U20 CO-14386-05 1 .072 .072 SGCKETS, 20PIN (64K ONLY) U23 CO14397-XX 1 .35 .35 PWR SWITCH TBD 18 0 SDCKETS, 18PIN U14-19 TBD 1 6.6 6.6 PCB, CRAZY 8 TOTALS: 39 10.802	54	CO-14386-0E	9 2	٦.		SOCKETS, 28PIN	W.11	ALL SUCKETS MAY BE DELETED
TBD 1 .1 .1 KEYBOARD CONNECTOR U6,U20 CO-14386-05 1 .072 .072 SOCKETS, 20PIN (64K ONLY) U23 CO14397-XX 1 .35 .35 PWR SWITCH TBD 18 0 SOCKETS, 18PIN U14-19 TBD 1 0 SOCKETS, 48PIN U13 TBD 1 6.6 6.6 PCB, CRAZY 8	52	CO-14386-0.	3 2	90.		SOCKETS, 16PIN	U3, 10, 21	
CO-14386-05 1 .072 .072 SUCKETS, ZOPIN (64K ONLY) UZ3 CO14397-XX 1 .35 .35 PWR SWITCH U14-19 TBD 1 0 SUCKETS, 18PIN U13 U13 TBD 1 6.6 6.6 PCB, CRAZY 8 10.802	26	TBD	-	.1.	-:	KEYBOARD CONNECTOR	U6, U20	
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1 6.6 6.8 PCB, CRAZY B TOTALS: 39 10.802	09	180	-		0	SOCKETS, 48PIN	U13	
39 10.802	19	180	_	9.9	9.9	PCB, CRAZY 8		TAIWAN; NO GOLD USED; BASED ON 2600 COST
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ITEN #	PART #	QUANTITY	UNIT COST	TOTAL COST	TOTAL COST DESCRIPTION	DESIGNATION		
64	TRN	_	4			1		
4 !	101	-	5.83	3.85	FRED CHIP, 48 PIN	1113		
63	CO-12294-A		2.5		PORKY CHIP. 40 PIN			
64	CO-14806	-	3,25		SALLY PHID /MON / CAN			
65	CO-12296	-	3.57		ANTIC CUTD MINUS 02027	45		
99	CO-14805	_	2,54	2.54	GTTA CHIL			
29	MK-2764	_	2.5	10		/n		
89	CO-14795		1.82	1.82	PIA DIAL KUM	5 5	6. SUMMER	
69	55-60473	2	4.75	2.5	RAM 14K*4	1114 15		
70	S-23128		5.8	8.0	RIFIS CHTP (14K*B)	1111	6. SUMMER: 4.50 UNIT COST	
71	CD-4050B	_	.17	.17	HEX CMGS BIFFFR: Chaosobly	זוווג	6. SURMEK: 5.00 UNIT COST	
72	7805	1	.35		VOI T. REGIII ATOR	114		
73	CD-4051	2	. 18		HFY CMOS RIFEED	5		
74	C014344	0	.26		741 5138	lion.	UNII CUSI ESIIMAIED	
75	TBD	-	.271	.271	LM3806 (RF)	97		
	TOTALS: 15	: 15		36.481	16K VERSION			
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							70 407 70 10 10 10 10 10 10 10 10 10 10 10 10 10	700 007

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7.6	34-2N3904	2	.049	860.	TRANSISTORS: 2N3904	01,04	
11	33-2N3906	m	.043	.129	TRANSISTORS: 2N3906	85,6,7	
78	34-2N3963	_	90.	90°	TRANSISTORS: 2N3963	92	
79	MR501	4	.105	.42	DIODES (BRIDGE RECT)	CR 3-6	
80	CO-14776		80.	80.	L.E.D.	CRB	
81	31-1N914	m	.015	.045	DIODE: RF	CR1,2,8	
82	C0-14384	C)	.025	.125	INDUCTOR: FERRITE BEAD	L6-8,11,12	
83	55-61090	-	ŗ.	r.	CRYSTAL: 14.31818 mHz	X1 HONG KONG ESTIMATE .35	MATE .35
84		0	0	0			
82		0	0	0			
88	C010823	2	890.	.136	INDUCTOR, VARIABLE	L3,9	
87	TBD	63	.0034	.2142	SIP RESISTORS	SIP 1-7	
88	TBD	36	.028	1.008	SIP CAPACITORS	SIP 8-11	
88	TBD	-	.045	.045	TRANSFORMER, RF		
	TOTAL	OTALS: 122		2.8602			•

7	OST TOTAL COST DESCRIPTION DESIGNATION			ALPS PRICE					•	
MECHANICAL	DESCRIPTION DESIGNATION		HEATSINK, REGULATOR	KEYBOARD	PLASTIC HOUS, TOP & BOTT	RF SHIELD, BOTTOM	RUBBER FEET	FCC LABEL	MISC HARDWARE	
	QUANTITY UNIT COST TOTAL COST DESCRIPTION		.584	8	2	.7		.03	.25	11.576
	UNIT COST		.584	8		.7	.003	.03	×	
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HECHANICAL	PART #		55-60581	TBD	TBD	TBD	180	TBD	×	TOTALS: 10
MECHANICAL	TEM #	t 1 1 1 1 1 1 1 1	06	91	42	93	94	95	9.6	

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ITEM #	PART#	QUANTITY	UNIT COST	TOTAL COST	TOTAL COST DESCRIPTION DESIGNATION	
47	C014744	-	.05	.05	POLY BAG	
86	TB0	-	æ	æ.	OPER MANUAL, INCL BAS&DWN	
66	C017710	-	.17	.17	WARRANTY CARD	
100	C017535	1	.22	.22	ATARI PCS PRODUCT GUIDE	
101	C015936		.03	.03	PUBL. QUEST.	
102	TBD	-	.01		PCB SERIAL # LABEL	
103	TBD	-	ĸ.		SHIPPING CARTON, INNER	
104	TBD	-	ĸ.		SHIPPING CARTON, W/PRINTING	
105	CA0-17964	-	3.41	3.41	POWER ADAPT. 15-25 V/A	ORIENT ESTIMATE \$2,00
106	SSA-61013	-	8.	8.	CABLE ASSY, COAX WITH TORROID	
107	180	-	.55	.55	TV SWITCH BOX	
	TOTALS: 11	= ;		7.04		
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	GRAND TOTALS: 311	3: 311	'84 EST	71.9562 . 64.8902	(SI COST DOWN 20%)	

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**Gregg W Squires** Manager Hardware Engineering ATARL

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